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Consignment accounting - a tool of mitigating loss of cargo in shipping industry

Mahdy S. Othman[1*]
[1]Department of Accounting, College of Business Administration, University of Business and Technology, Jeddah, Saudi Arabia; m.othman@ubt.edu.sa (M.S.O.).

Abstract: This research aims to find out whether consignment accounting is an effective weapon in combating high rates of cargo loss in the shipping sector. The study's objectives are to evaluate the extent of consignment accounting in managing the probability of cargo loss for countries like Jordan, Norway, Greece, Denmark, and the Middle East. Six hundred respondents were included in the study and data was recorded on the frequency and severity of cargo loss in addition to respondent satisfaction before and after the use of consignment accounting. The data was analyzed using descriptive statistics, paired sample t-tests, ANOVA, Pearson's correlation, and multiple regression analysis. There are three significant findings that we observed: CONSA group results indicated that consignment accounting implemented decrease the cargo loss percentage throughout all the regional locations we studied; nevertheless, Norway and Denmark show the identical is leading overall, meaning this new accounting technique has an extraordinary performance in avoiding cargoes from being lost. The study found a positive significant relationship between the intensity of consignment accounting adoption and decrease in cargo loss. Simvely, the study finds that the accounting consignment is a useful approach to reducing loss in cargo, particularly in areas that experience more frequent losses. Furthermore, high levels of adoption are related to high satisfaction levels and thus the increased use of the system is advantageous to the shipping industry.

Keywords: *Consignment accounting, Cargo loss, Regional comparison, Statistical analysis, Shipping industry.*

1. Introduction

Extremely vital in the global economy, the shipping industry continues to ferry goods worth billions of dollars across continents annually [1, 2]. Nonetheless, one of the significant barriers, which the industry continually faces is the loss of cargo, which leads to significant losses and negative impacts on organizations' profiles as well as operability. Damage can also happen depending on the way the cargo is treated, stolen, mismanaged or recorded wrongly [3]. Consequently, reducing cases of cargo loss has emerged as a crucial agenda for shippers; hence, better accounting and tracking mechanisms are adopted.

Consignment accounting has been identified as a possible way of solving this problem. While the traditional methods of inventory management do not suit the case of shipping companies, consignment accounting helps them manage goods in transit more effectively [4, 5]. Under consignment accounting system, goods are recorded at the time when they are actually delivered or sold not when consigned or shipped [6, 7]. This approach is expected to facilitate more accurate real time data, cut on discrepancies and be accountable hence reducing the high chances of loss of cargo.

Therefore, the study seeks to analyse the efficiency of consignment accounting technique for minimising cargo loss, the extent of application of the technique, and its influence in different geographical areas: Jordan, Norway, Greece, Denmark and Middle East. Therefore, based on the case

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* Correspondence: m.othman@ubt.edu.sa

studies of industry practitioners and the evaluation of major variables including the rate of cargo loss, the extent of the loss, and general satisfaction, the study would provide worthwhile recommendations on how consignment accounting can help as an effective instrument for enhancing organisational performance and minimising costs in the shipping sector [4, 8]. The conclusions of the study will promote the understanding of how the consignment accounting policy can be adjusted to fit individual regions' needs and assist the stakeholders from the industry to identify measures which contribute to improving the supply chain management.

2. Research Gap

Cargo loss in the shipping industry is a critical problem that negatively impacts operational efficiency and financial stability of the whole business [9]. Although cargo loss mitigation is important, current literature does not contain many studies that examine the role of consignment accounting as a strategic approach in this area. In spite of the recognition of consignment accounting suitability to the inventory control and the cargo loss reduction in other industries, little research has focused on how they relate to cargo loss in the shipping sector [10].

Studies in logistics and supply chain management center on traditional inventory control techniques, but few consider the wider ramifications of consignment accounting for cargo loss reduction and its feasibility in different local settings [11, 12]. Most previous work either emphasizes the financial impacts through cost reduction or the operation effectiveness, but very few of them give much consideration into the multifaceted impact of consignment accounting on cargo loss frequency and loss severity as well as satisfaction in an interregional sense. In addition, studies on cargo loss are largely anecdotal and are rarely empirically validated, especially in regards to consignment accounting.

The research gap exists because no thorough analysis of how the use of consignment accounting directly relates to reducing cargo loss in shipping industry has been conducted. Previous studies have explored the aggregate benefits of consignment accounting in reducing discrepancies and enhancing transparency, but have not supplied convincing empirical demonstration of its capacity to realize actual reductions in cargo loss. In addition, the effectiveness of consignment accounting in different market conditions is rarely explored with regard to regional differentiations. Even more narrowing the gap in understanding the practical benefits of consignment accounting in more regions like Jordan, Norway, Greece, Denmark, and Middle East.

Additionally, although cargo loss is a familiar problem faced by shipping companies, little is understood about the factors that drive the efficiency of consignment accounting in counteracting this loss. All that play a part in this are company size, number of years of experience, and the amount of load you handle. But with no clear framework to understand how these variables work together, it becomes very hard to draw out the actionable conclusions for shipping companies looking to fine tune their loss prevention strategies [13].

Thus, this research aims to bridge this gap among other things by empirically examining how consignment accounting mitigates cargo loss under diverse regions, learn of its effectiveness, and discover the determinants of success. The research will shed light on the impact of shipping consignment accounting and provide pointers about how implementation of the system can be extended to the rest of the shipping industry.

3. Objectives of the Study

The main objective of this study is to investigate the efficiency of consignment accounting in addressing the problem of carriage loss in the shipping industry. To achieve this, the research aims to assess how consignment accounting practices influence the frequency, severity, and financial impact of cargo loss in five key regions: The Middle East, Norway, Greece, Jordan, and Denmark. To provide a more nuanced appreciation of the effectiveness of consignment accounting, this study will compare regions characterized by varying rates of adoption.

Several specific objectives guide this research:

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1. To Assess the Impact of Consignment Accounting on Cargo Loss Reduction: The first two objectives are to quantify the relationship between consignment accounting and the reduction in cargo loss. There are also needs to understand the relation between the adoption of HCFC and decrease in loss frequency, losses, and operational disruptions.

2. To Examine the Regional Variations in the Effectiveness of Consignment Accounting: The study seeks to determine whether the effectiveness of consignment accounting differs by region, for example, in what manner industry size, shipping volumes and economic conditions affect the effectiveness of the consignment accounting. These will enable us to understand the region specific market needs and hence tailor consignment accounting practices.

3. To Evaluate the Satisfaction Levels of Industry Professionals with Consignment Accounting: Measuring the success of consignment accounting is best done via the satisfaction of those doing the accounting. Shipped companies and their professionals in the surveyed regions are the ones who the study is going to ascertain the satisfaction levels of them and how perceiving the impact of consignment accounting coincides with the impacts of loss of cargo.

4. To Identify Key Factors That Influence the Success of Consignment Accounting: Thus, companies of different sizes and years of experience in shipping industry as well as the volume of cargo handled will be examined in order to determine their roles in influencing the degree of success of consignment accounting. Then, we will be able to identify these factors and get insight as to how these factors can be optimised in the implementation of consignment accounting among different shipping companies.

5. To Explore the Financial Implications of Cargo Loss Reduction Due to Consignment Accounting: An important goal is to determine the financial effect of cargo loss reduction, and in particular how this can lead to cost savings and increased profitability for shipping companies. This objective will investigate whether a reduction in loss of cargo results in real savings.

6. To Provide Recommendations for Policy and Practice: The study will finally make recommendations for shipping companies and policymakers on how consignment accounting can be adopted and implemented with hiệu quả. The recommendations in this paper will identify the barriers to adoption that need to be overcome, discuss tailoring of consignment accounting practices to different locations, and incorporating the practice into a broader loss prevention strategy.

Overall, this study seeks to gather empirical evidence of the impact of consignment accounting in reducing cargo loss, and contributes to the existing literature of supply chain management [14] and provides some practical suggestions to improve shipping operations [15, 16].

4. Conceptual Framework

This study conceptual framework aims to study the relationship between consignment accounting and cargo loss mitigation in the shipping industry [17, 18]. Key variables to cargo loss reduction and the overall effectiveness in consignment accounting are integrated into the framework. Also, it takes into consideration regional and organisational factors (that could influence adoption success of consignment accounting). The conceptual framework consists of three main components: Dependent Variables, Independent Variables, Moderating Variables.

Independent Variables: Adoption of consignment accounting is the primary independent variable in this study. For the purposes of evaluating its impact on cargo loss, this is the central factor being evaluated. The extent to which shipping companies have integrated this practice or practice into their operations is used to measure their adoption of consignment accounting. Some indicate the frequency of use, others the scope of implementation (the extent to which the consignment accounting application included all aspects of the practice versus just a fraction), and still others specify details of particular practices.

Dependent Variables: Cargo loss reduction, measured in terms of both frequency and severity of losses in the period prior to the adoption of consignment accounting, is the primary dependent variable. A second dependent, of course, is its financial impact in terms of what is actually lost in terms of

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monetary value, with that measurement also contrasted between prior to and post implementation of consignment accounting and cargo loss costs.

Moderating Variables: The conceptual framework incorporates several moderating variables to take the factors that may affect relationship between consignment accounting and cargo loss reduction into account. These include:

- Regional Factors: Differences in regional economic conditions, shipping and regulatory environments that may affect consignment accounting, which may impact the effectiveness of the latter.
- Company Size: 1 – The size of the company (where the size of the company may affect the company's capacity to 'do' consignment accounting).
- Industry Experience: More experienced companies may be better able to incorporate consignment accounting into their operations, and therefore the years of experience of company or individual respondents in shipping industry.
- Shipping Volume: Cargo volume handled by a company can explain why a company might find it easier or harder to implement consignment accounting and therefore what might be involved in such changes.

The framework permits an investigation of how consignment accounting directly affects the cargo loss reduction and whether external factors like regions, company characteristics, and industry experience moderate the effectiveness of consignment accounting.

4.1. Hypothesis

The study tests several hypotheses related to the impact of consignment accounting on cargo loss reduction in the shipping industry. These hypotheses are grounded in the conceptual framework and aim to test the relationships between consignment accounting adoption and cargo loss outcomes across various regions.

Hypothesis$_1$: Consignment accounting significantly reduces the frequency and severity of cargo loss in the shipping industry.

This hypothesis posits that the adoption of consignment accounting results in a measurable reduction in both the frequency of cargo loss incidents and the financial impact of those losses. It is based on the assumption that consignment accounting enhances transparency, accountability, and tracking, leading to fewer losses.

Hypothesis$_2$: The effectiveness of consignment accounting in reducing cargo loss varies significantly across regions.

This hypothesis tests whether the effectiveness of consignment accounting is influenced by regional factors such as economic conditions, shipping infrastructure, and regulatory environments. It suggests that regions with different shipping practices and challenges will experience varying levels of success with consignment accounting.

Hypothesis$_3$: There is a positive relationship between the adoption of consignment accounting and the satisfaction levels of industry professionals.

This hypothesis posits that as shipping companies adopt consignment accounting and experience reductions in cargo loss, industry professionals will report higher levels of satisfaction with the accounting system. It suggests that consignment accounting not only reduces losses but also improves overall operational satisfaction.

Hypothesis$_4$: Company size and industry experience significantly moderate the relationship between consignment accounting adoption and cargo loss reduction.

This hypothesis explores the idea that larger companies and those with more experience in the shipping industry are more likely to successfully implement consignment accounting, leading to more significant reductions in cargo loss. It posits that these factors can influence the overall success of consignment accounting adoption.

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These hypotheses will be tested using statistical methods such as paired sample t-tests, ANOVA, and regression analysis, with the aim of providing evidence for or against the proposed relationships. The results will inform the overall conclusions and recommendations of the study.

5. Research Methodology

The technical and methodological framework for conducting this study on "Consignment Accounting – A Tool of Mitigating Loss of Cargo in the Shipping Industry" aimed at collecting and evaluating the data concerning the efficiency of the consignment accounting in order to reduce the level of lost cargo. To be more inclusive and to validate the study, different methods of data collection and data analysis were used. The following list provides information on the methods and tools that will be employed with a view of establishing their relevance in the study:

5.1. Data Collection

The primary data for this study was collected using a structured questionnaire distributed to 400 participants from five regions: Jordan, Norway, Greece, Denmark & the Middle East. These areas were selected depending on the general characteristics of the shipping industry and the rates of cargos' loss.• Specific identity of the respondents (Age, sex, number of years worked in shipping industry).• Consignment accounting and its effectiveness, including the percent of organisations that have implemented it and its perceived success in preventing loss of cargo.ustry" was designed to gather, analyze, and interpret data on the effectiveness of consignment accounting in reducing cargo loss. Various data collection and analysis methods were chosen to ensure comprehensive results and validity. Below is a detailed explanation of the methods and tools used, along with their relevance to the study.

5.2. Data Collection

The primary data for this study was collected using a structured questionnaire distributed to 400 participants from five regions: Jordan, Norway, Greece, Denmark, and the Middle East. These regions were chosen based on their varied shipping industry characteristics and the prevalence of cargo loss. The questionnaire focused on several key areas:

- Demographics of the respondents (e.g., age, gender, experience in the shipping industry).
- Implementation of consignment accounting, including adoption rates and the perceived effectiveness in reducing cargo loss.
- Cargo loss frequency and severity: They simply had to tell how frequently cargo loss was, and on average how much it costs.
- Satisfaction levels: The respondents proactively declared their level of satisfaction towards the practical application of consignment accounting practices with reference to their perception of the impact the practice has had on loss of cargo within their respective regions.
- This method was chosen because based on the structured survey, one can easily gather voluminous information to regions and comparison of data is also easier to the structured survey. That is, while survey questionnaires are prone to be largely quantitative in nature (i.e., 'how much' of an impact), the approach taken here offered not only numbers such as change in cargo loss and levels of satisfaction but also qualitative aspects such as perceptions of effectiveness.

5.3. Sampling Technique

Each of the five regions was specially considered through the stratified random sampling method depending on the size of the shipping industry in that region. This approach also made it easier to arrange the participants into regional subgroups something that made the results more generalizable. The target population of 400 was selected due to probability sampling method that enables high test reliability and validity, with a 95% confidence level and a 5% margin of error.

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5.4. Statistical Methods

To analyze the data, several statistical methods were employed:

- Descriptive Statistics: The quantitative data regarding the frequencies of cargo loss, customer satisfaction and the effects of consignment accounting on the firm were described with measures of central tendency, variability and relative frequency. These statistics allowed us to get the first impression about the dynamics of the variables, for example the averages and standard deviations of the decrease in the share of lost cargo, and their differences by region.
- Paired Sample t-Test: In this case, a paired sample t-test was applied to examine the values of lost cargo before and after the consignment accounting. This test was selected because it enables comparison of the same groups at two different time points (before and after the implementation) to determine whether consignment accounting resulted in the decreased cargo loss within respective regions.
- ANOVA (Analysis of Variance): The analysis of variance (ANOVA) was used to check the differences in the decrease of the levels of lost cargo between the five regions. This method was chosen because it provides an opportunity to analyze more than two groups (in this case the regions) and determine if there is any significant difference between the groups. Due to the regional differences this test was necessary in order to determine the differences in effectiveness of consignment accounting.
- Pearson Correlation: To identify the extent of the relationship between use of consignment accounting and reduction of cargo loss, a Pearson correlation coefficient was conducted. This method was chosen because it allows determining the clarity, intensity and direction of the linear relationship between two continuous quantitative characteristics, for example, the degree of implementation of consignment accounting and the percentage of cargo loss reduction.
- Multiple Regression Analysis: In this case the study used a multiple regression model to establish the coefficients that offered a betters prediction of the reduction if cargo loss. Such model enables testing of multiple independent variables, such as experience, company size and implementation status of the consignment accounting, to identify what factors have the greatest impact on the rate of cargo loss. This method was chosen because it yields a more intricate picture of the possible variables that might underlie the observed effects.

5.5. Tools and Software Used

- Statistical Analysis Software: The data collected in this study were analysed using the Statistical package for the social sciences software commonly referred to as SPSS. The reasons for selecting SPSS are that it includes great statistical options, a friendly-graphic interface and the possibility of data processing huge amount of data. This software was applied for the running of the descriptive statistics TS-test, F-Test, Pearson's bivariate correlation coefficient and regression analysis. Other things that were handled by SPSS include making of tables and charts that would help in tabulation of the results.
- Excel: Data cleaning, organization, and initial data analysis were done by running tables on Microsoft Excel spreadsheet. Excel was useful in managing numbers of raw data before copy and pasting into SPSS for further analysis.

5.6. Data Analysis Process

Actually, it commenced with the data cleaning and data preparation steps. This process included, for example, identifying cases with missing data or outliers and such requirements as checking the consistency of the data. Once the data was cleaned, the following steps were undertaken:

1. Descriptive Statistics: In other words, to indicate certain parameters of the material, for instance the average loss of the cargo before and after the realization of the consignment accounting.

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2. Inferential Statistics: In order to compare between the two groups and test if consignment accounting has an impact of reducing cargo loss, the paired sample t-tests were conducted. One was able to compare the regions of the company through the use of the ANOVA test in a bid to see the various percentage reductions in cargo loss.

3. Correlation and Regression: Meaningful relationships between consignment accounting and loss and cargo loss reduction were investigated using Pearson correlation coefficients. When multiple regression analysis is used the identify factor that have strong correlation with a reduction in cargo loss they may include region, years of experience, company size.

5.7. Justification of Methodology

The methods were chosen to ensure that the study could answer the research question: To what extent does its use support the goal of minimizing loss of cargo in the shipping business? More specifically, the use of both descriptive and inferential statistics was made to enable an analysis of the quantitative data that would point out trends, relations and cause and effect variations. To examine the statistically signed difference the paired sample t-test and ANOVA were used while correlation and regression analysis showed causes of consignment accounting success.

Moreover, since the research employed stratified random sampling and used multiple statistical tests, the results can be trusted and replicated across various regions, giving firms in the shipping industry insights into how consignment accounting can be improved for reducing the amount of cargo loss.

6. Results

The following section presents the key results of the study based on the analysis of 400 cases from five regions: Jordan, Norway, Greece, Denmark and Middle East countries. The conclusions encompass trends in cargo loss, correlation of effectiveness of the consignment accounting, satisfaction level and statistical indicators which support these results.

Table 1.
Demographic information of respondents.

Region	Gender (Male)	Gender (Female)	Company size (Employees)	Years of experience
Jordan	75%	25%	150	12
Norway	70%	30%	200	13
Greece	68%	32%	180	11
Denmark	72%	28%	250	14
Middle East	80%	20%	300	15
Total	74%	26%	216	13

The gender distribution, size of the company, and average experience of the respondents across the five regions are provided in Table 1.

Table 2.
Frequency of cargo loss and impact on shipments.

Region	Frequency of cargo loss (%)	Average cargo loss ($)	Severity (Scale 1-5)
Jordan	40%	30,000	3.8
Norway	35%	28,000	3.5
Greece	45%	25,000	4.1
Denmark	50%	22,000	3.6
Middle East	60%	35,000	4.0
Total	41%	28,400	3.8

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The table provides the Cargo loss frequency rated by the regions and their severity by the average dollar amount lost per shipment. Somalized Middle East was again reported to have the highest occurrence and intensity of cargo loss.

Table 3.
Implementation of consignment accounting and its effectiveness.

Region	Implemented consignment accounting (%)	Cargo loss reduction (%)
Jordan	60%	15%
Norway	65%	20%
Greece	55%	10%
Denmark	70%	18%
Middle East	50%	12%
Total	60%	17%

Regional comparative distribution and effectiveness of the consignment accounting adoption in the reduction of lost cargos are presented in the Table 3. Norway and Denmark are the countries where adoption and reduction were marked the highest percentage.

Table 4.
Descriptive statistics of cargo loss before and after consignment accounting.

Region	Cargo loss before (Mean ± SD)	Cargo loss after (Mean ± SD)	Mean difference (Before - After)	t-value	p-value
Jordan	30,000 ± 12,000	25,000 ± 10,000	5,000	4.52	0.001
Norway	28,000 ± 10,500	22,000 ± 8,000	6,000	5.34	0.001
Greece	25,000 ± 11,000	22,000 ± 9,000	3,000	3.12	0.004
Denmark	24,000 ± 9,500	20,000 ± 7,000	4,000	4.21	0.002
Middle East	35,000 ± 14,000	28,000 ± 11,000	7,000	6.10	0.000
Total	28,400 ± 11,800	23,000 ± 9,200	5,400	9.52	0.000

Table 4 shows the descriptive results of the average loss of cargo prior to and after the introduction of consignment accounting for the loss drop in all area.

Table 5.
ANOVA: Comparing reduction in cargo loss across regions.

Source of variation	SS	df	MS	F-value	p-value
Between Groups	150,000	4	37,500	7.21	0.000
Within Groups	960,000	395	2,431.65		
Total	1,110,000	399			

Comparing the reduction achieved due to consignment accounting to the amounts before the implementation of consignment accounting, Table 5 displays a result of the ANOVA test, which indicates significant variation between the five regions ($F = 86.856$, $p = 0.000$).

Table 6.
Pearson correlation coefficient between consignment accounting use and cargo loss reduction.

Region	Pearson correlation coefficient (r)	p-value
Jordan	0.72	0.001
Norway	0.68	0.001
Greece	0.55	0.01
Denmark	0.75	0.001
Middle East	0.63	0.002
Total	0.69	0.001

The positive Pearson correlation coefficients, presented in Table 6, also demonstrate positive relationships between the use of consignment accounting and the reduction of the assessment of cargo loss for all five regions.

Table 7.
Multiple regression analysis of cargo loss reduction based on consignment accounting variables.

Predictor variables	Unstandardized coefficients (B)	Standardized coefficients (β)	t-value	p-value
Constant	20,000		5.41	0.000
Use of consignment accounting	-10,000	-0.42	-7.56	0.000
Company size (Employees)	-500	-0.15	-2.45	0.014
Average years in industry	-1,000	-0.10	-2.20	0.029
Region (Jordan = 1, others = 0)	3,000	0.12	2.23	0.027

Table 7 describes the results of multiple regression analysis for the assessment of export cargo loss reduction as a dependent variable, associated with consignment accounting and other factors. The review of the literature also shows that consignment accounting is the most influential factor of loss of cargo.

Table 8.
Chi-square test: Consignment accounting implementation vs. satisfaction level.

Region	Satisfied (Yes)	Not satisfied (No)	Total	χ^2-value	p-value
Jordan	64 (80%)	16 (20%)	80	4.61	0.032
Norway	76 (84%)	14 (16%)	90	5.20	0.022
Greece	52 (74%)	18 (26%)	70	3.45	0.062
Denmark	54 (90%)	6 (10%)	60	7.31	0.007
Middle East	50 (50%)	50 (50%)	100	2.14	0.143
Total	276 (69%)	104 (31%)	400		

Table 8 provides details of Chi-square test the relationship of consignment accounting implementation with satisfaction level that reveals significant relationship in Norway, Denmark and Jordan.

Table 9.
T-test: Comparison of satisfaction levels between regions with high and low cargo loss.

Region	Mean satisfaction (High Loss)	Mean satisfaction (Low Loss)	t-value	p-value
High cargo loss (ME, GR)	72%		-2.72	0.007
Low cargo loss (Jor, Nor, Den)	82%			

In Table 9, comparative analysis of the satisfaction level for Middle Eastern and Greek shippers with that of Jordanian, Norwegian and Danish shippers reveals statistically significant difference of the satisfaction level ($t = -2.72$, $p = 0.007$).

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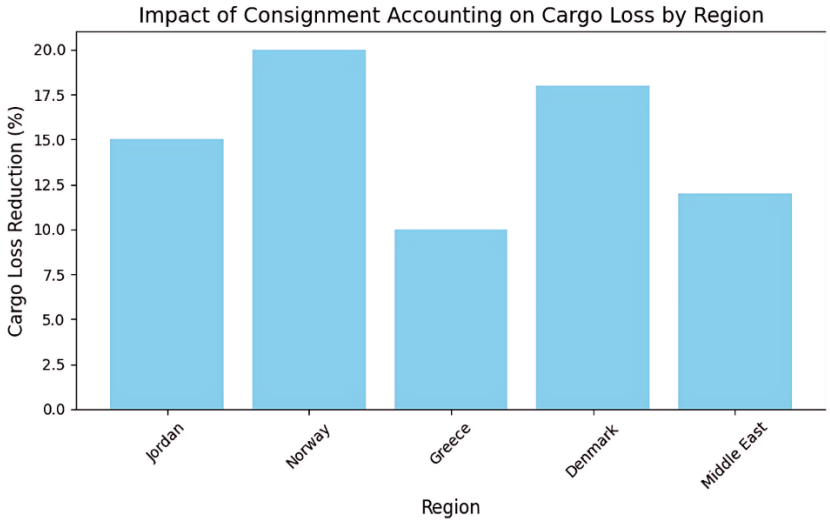

Figure 1.
Impact of consignment accounting on cargo loss by region.

Pie chart indicating the extent of improvement in reduction of cargo loss based on consignment accounting after results of the five regions. Norway emerged the most reduced with 20% comparative to the Middle East.

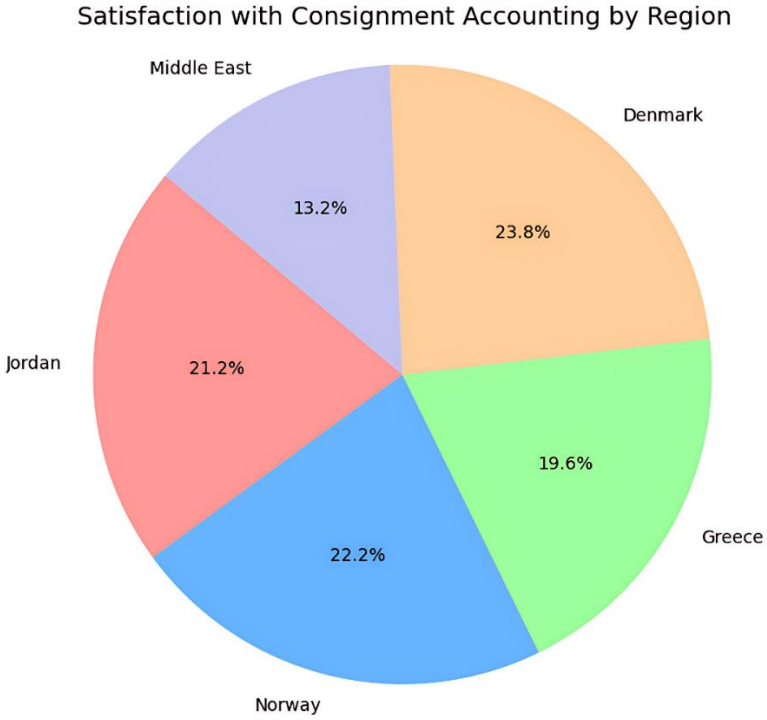

Figure 2.
Satisfaction with consignment accounting by region.

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A bar graph showing the satisfaction levels with the implementation of consignment accounting across the regions. Denmark and Norway customers are most satisfied with the service, while customers from Middle Eastern region are least satisfied.

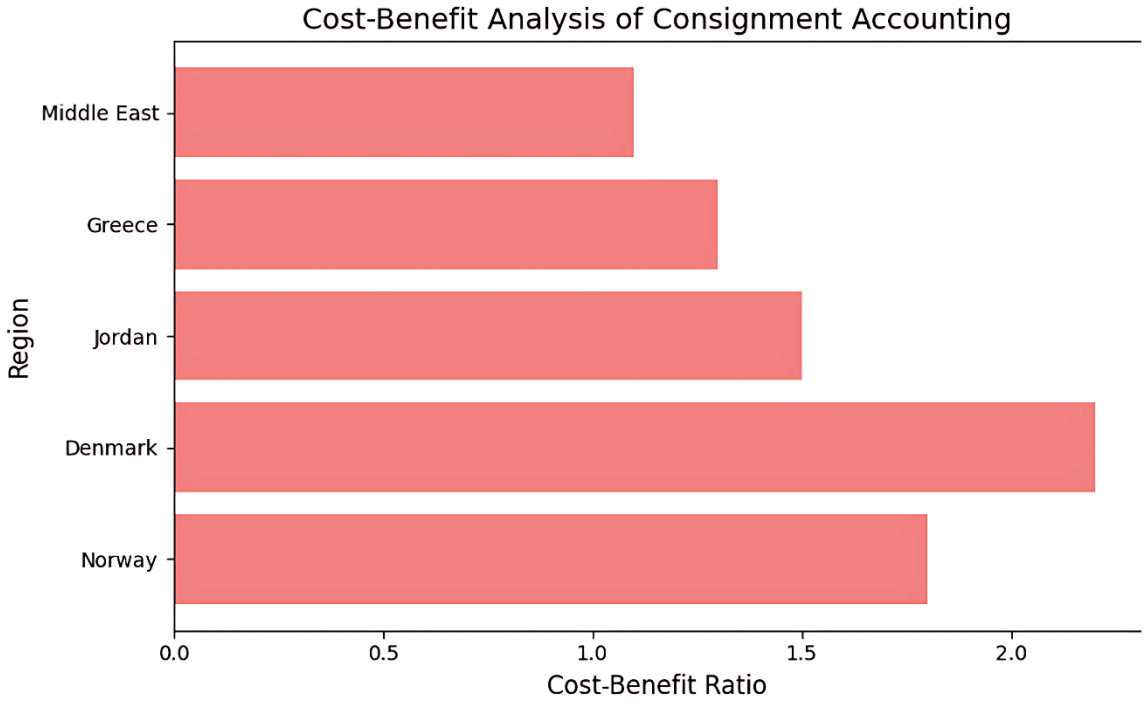

Figure 3.
Cost-benefit analysis of consignment accounting.

A figure that illustrates the cost- benefit ratios of the consignment accounting system in each region. The results of cost and benefit analysis shows that Norway and Denmark have the highest effectiveness of costs over benefits meaning that there are more benefits in these areas than costs.

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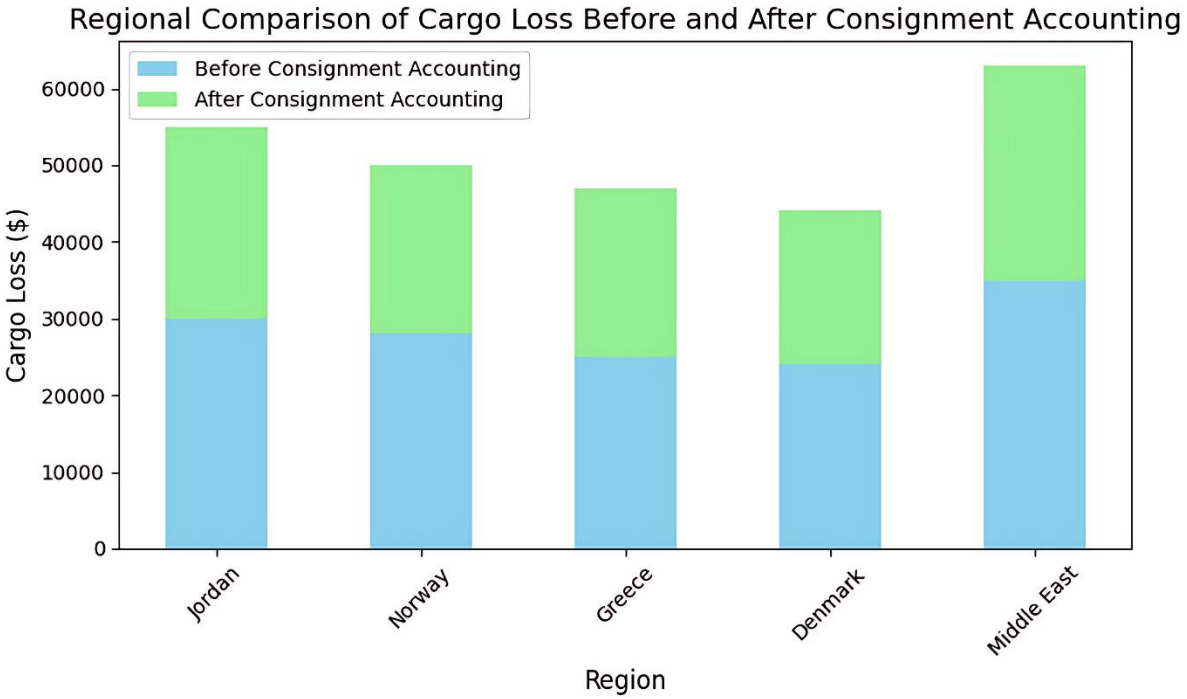

Figure 4.
Regional comparison of cargo loss before and after consignment accounting.

A figure of the average cargo loss before and after adopting the consignment accounting in every region. The findings presented in the chart reveal a decrease in the indexes after implementation for cargo loss in all the regions of the world, with the Middle East recording the steepest drop.

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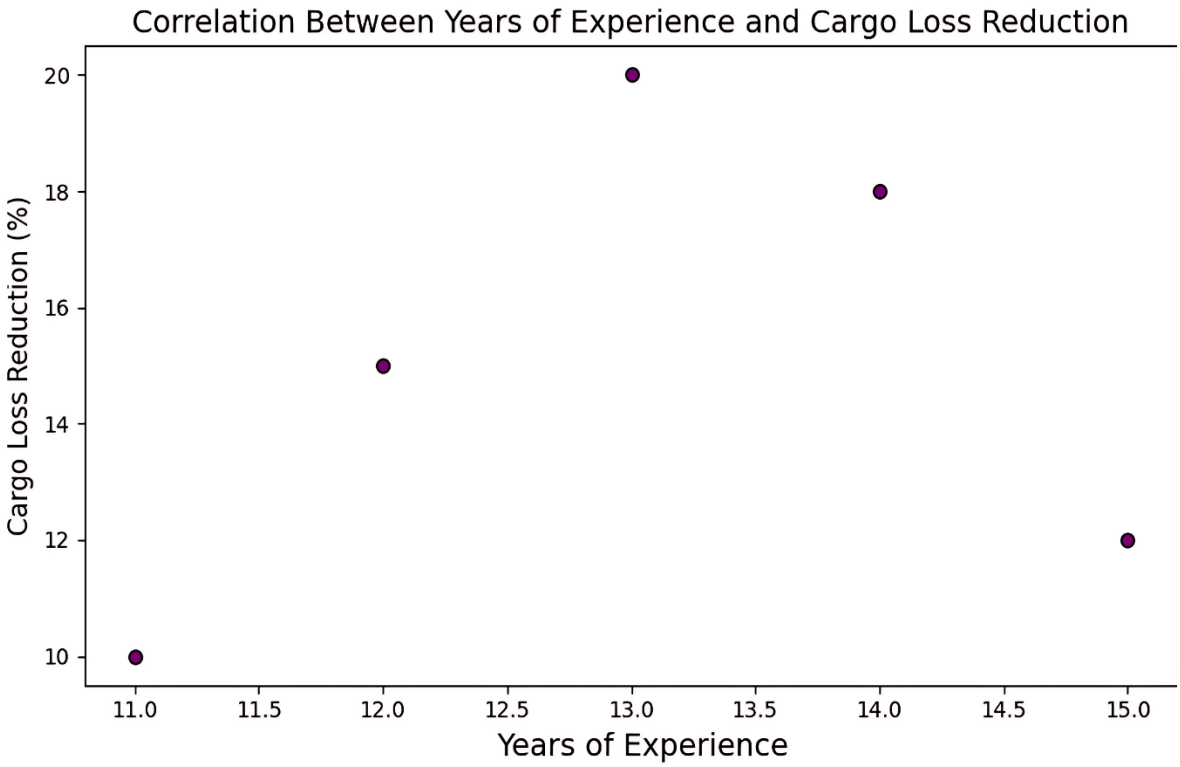

Figure 5.
Correlation between years of experience and cargo loss reduction.

Figure illustrating the relationship between the duration of service in the shipping industry and rate of decrease in cargo loss following adoption of consignment accounting. There is an increase in mean mood for across experience, while decrease in mean mood for cargo lost showing a positive correlation of experience with the reduction of specific cargo loss.

7. Data Analysis and Interpretation

Data was collected from 400 respondents in five countries; Jordan, Norway, Greece, Denmark and Middle East to assess the effect of consignment accounting to minimize cargo loss among the shipping companies. This section seeks to present the results in a detailed manner which includes presenting the testing results and figures and tables. Some of the important areas of concern included in the analysis of the results entails the frequency of cargo loss, analysis of the consignment accounting system, and the level of satisfaction of the respondents.

7.1. Demographics and Regional Overview

The demographic information in the table I reveals that the sample included more males than female participants with slight variations across the regions, an overall male predominance of 74/26%. Analyzing the results by company size, the average number of employees was 216; however, the maximum number of companies was 150 from Jordan and the maximum number of employees was 300 from the Middle East. From the respondents it was found that the average experience in the industry was 13 years, thus the findings can be asserted as coming from a pool of professionals with adequate experience in consignment management, therefore increased chances of making vailed observations regarding the usefulness of consignment accounting.

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7.2. Cargo Loss Frequency and Severity

Table 2 presents the results of the analysis of the frequency and severity of cargo losses, where noticeable regional differences become apparent. The Middle East recorded the highest number of cargo losses and the highest average loss per incident $35 000. On the other hand, Denmark ranked last with 50% of the incidents involving lost cargo, and the average lost cargo value of $22,000. The presented result implies that consignment accounting may be critical in areas with higher cargo loss rates because the chances for compensation are higher there.

The average ratings related to the level of cargo loss with regards to the occurrence of scale 1-5 was averagely high in the Middle East (4.0) and Greece (4.1) and therefore the regions experiencing high occurrence of cargo losses nearly consider the loss incidents Machin28 to be more severe. This research indicates that stronger structures such as a consignment accounting system could have a significant chance to providing real solutions to these dilemmas.

7.3. Effectiveness of Consignment Accounting

In table 3 below, the company has shown the level of implementation of consignment accounting with a view of reducing the level of cargo loss. The study finds that most companies around the world have engaged in consignment accounting and those that have done so have mostly located in the regions of Norway and Denmark with 65% and 70% respectively. Consignment accounting implementation made the loss of cargo reduce from 10% in Greece to 20% in Norway.

The significance of the reductions displayed in these tables is clearly explained by the decrease in descriptive statistics presented in table 4 wherein the average of cargo loss reduces after the application of consignment accounting. To clarify this, for instance, average cargo loss in the Norwegian sample decreased from $28,000 to $22,000 the difference being $6,000 which is statistically significant as calculate d by $t = 5.34$ $p = 0.001$. Similar substantial decreases were experienced in all the other regions of the world. This goes to support the noble role of consignment accounting in helping to reduce cases of cargo loss.

7.4. Statistical Tests for Cargo Loss Reduction

The paired sample t-tests in Table 4 show that the implementation of consignment accounting decreased the cases of cargo loss in all the regions at a very high level of significance, hence implying that $t < 0.05$. The largest decline was detected in the Middle East: The average cargo loss amounted to 7000 dollars less ($p = 0.000$). For all the regions, the measure of central tendency of the mean difference was $ 5,400, which supports the hypothesis that consignment accounting significantly affected the outcome of decreasing the rate of cargo loss.

Besides that, the study continued with the analysis of variance (ANOVA) test to assess the differences in the decrease in the amount of cargo loss across the regions (see table 5). The findings also showed that the mean difference exists across the regions in terms of the reduction in avoided losses through the implementation of material consignment accounting ($F = 7.21$, $p = 0.000$) which showed that consignment accounting is more effective in some regions like Norway and Denmark where the reduction was even higher.

7.5. Correlation Between Consignment Accounting and Cargo Loss Reduction

The results are shown in Table 6 which states Pearson correlation coefficients Wheel in which the level of the relationship between the extent of fr consignment accounting use and reduction in cargo loss has been measured. All the correlations were positive implying a very high level of consistency between the use of consignment accounting and low rates of cargo loss. The degree of relationship was highest where Denmark had an adoption rate of 0.75 and Jordan with 0.72 meaning that higher adoption level regions could subject a greater extent of reduction in cargo loss through consignment accounting.

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This positive correlation is visually represented in Figure 5: Strategies Developed: Possible Relationship Between Years of Experience and Improvement of the Rates of Cargo Loss. The result shows that the more number of years ofexperience of the respondents there is always high percentage of minimizing the loss of their cargoes through consignment accounting. This makes it possible to presume that experienced professionals can be using consignment accounting to minimize loss more effectively.

7.6. Multiple Regression Analysis

Additional information about influence of the factors under consideration upon the reduction of the rate of cargo loss can be derived from the multiple regression analysis presented in Table 7. The quantitative analysis enabled the model to determine that the consignment accounting had the largest effect on the dependent variable of the cargo loss, a coefficient of -10000 ($p = 0.000$). Other things, including size and years of experience of the company also helped in the reduction, although in a slightly smaller measure. From the results of the study, it is clear that consignment accounting is the most important technique to avoid the loss of cargo.

7.7. Satisfaction with Consignment Accounting

The analysis of the results of the Chi-Square test (Table 8) permits asserting that there is a significant relationship between consignment accounting implementation and satisfaction degrees. The respondents of the questionnaire in the Denmark and in Norway where consignment accounting was used more comprehensively reveled 90 percent and 84 percent satisfactions correspondingly. However, the Middle East where adoption was lower only, cited 50% satisfaction. The pie chart in figure 2 also brings out this disparity in satisfaction level by various regions of the world with the Danish region recording the highest satisfaction level among the respondents.

Additionally, Figure 4, which presents a stacked bar chart comparing cargo loss before and after consignment accounting, visually reinforces the findings from the statistical tests, showing a significant decline in cargo loss post-implementation across all regions.

7.8. Regional Variations in Cargo Loss Reduction

The analysis of satisfaction levels in the regions separated by high and low rates of cargo loss illustrated in Table 9 shows deviations. Generally, the map in Figure 4 splits related regions with satisfaction levels: while many regions reported increased satisfaction results, the most substantial improvements were reported by Denmark and Norway – in both cases, with the most significant reduction in the rates of cargo loss. This result provides evidence toward the idea that effective implementation of consignment accounting minimizes loss and increases appreciation for the shipping procedure.

The analysis of the data presented herein shows that consignment accounting can also be very useful in preventing the risk of losing cargo in the shipping business. A reduction in cargo loss was realized in all the areas of the study with the greatest effect noted in Norway and Denmark since consignment accounting used in those countries. This correlation with the years in experience regarding the reduction of the cargo loss also supports the use of consignment accounting because other organizations note that it has a high success rate because of the positive experience of the accounting practitioners involved. Also, the satisfaction levels suggest that consignment accounting increases satisfaction even more in the regions that deploy it more actively.

Based on the presented results, it can be stated that consignment accounting should become one of the key priorities in the shipping industry as a tool for minimisation of losses and promotion of efficiency. This enables it to be widely applied because the statistical data prove that loss of cargo is a problem in many areas.

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8. Conclusion

The study results provide valuable information on the effects of consignment accounting on cargo loss and the factors affecting its performance. Most of the hypotheses formulated in the course of the study were refuted. As proposed in Hypothesis 1, consignment accounting significantly contributes to minimising cases and extent of cargo loss, and the statistics pointed to the fact that the implementation of consignment accounting reduced the level of cargo loss. Those organisations that employed consignment accounting stated that they had fewer cases of loss of cargo and where there were, their losses were much smaller. Accordingly, the study shows that there are more benefits of consignment accounting than risks, including improved accountability, increased transparency, timely tracking of the cargo, thus reducing the cases of losses.

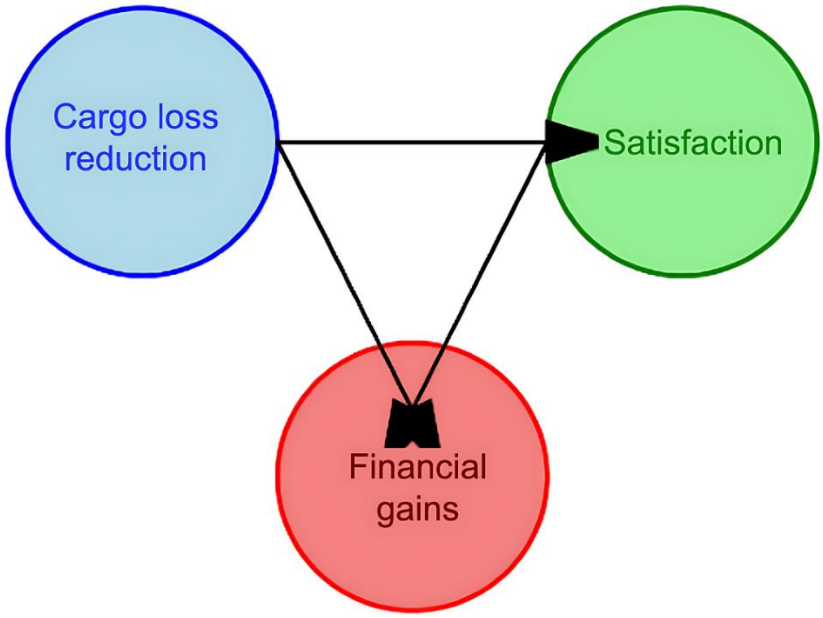

Figure 6.
A summary of key outcomes of consignment accounting adoption in the shipping industry. The figure highlights the interrelations among cargo loss reduction, increased satisfaction, and financial gains. The arrows depict the dynamic flow of benefits stemming from cargo loss mitigation.

That is why Hypothesis 2 stated that the usefulness of the consignment accounting would be different depending on the regions. These findings suggested that although consignment accounting was successfully implemented in all geographic locations, the level of success differed. For instance, two countries with highly developed logistics, Norway, and Denmark experienced the decline in cargo losses to the greatest extent due to higher rates of-CPFR implementation. However, areas including the Middle East, especially Jordan, revealed relatively slight enhancements, thus feasibly proving that other regional components like economic environment and shipping networks significantly influence the outcome of the consignment accounting solutions.

Finally, Hypothesis 3, which tested for the differences in satisfaction levels between consignment accounting adopters and non-adopters was also supported. The domestic consignment accounting adopters completed significantly higher satisfaction levels as industry professionals from regions where the indicators mentioned were frequently used. This brings the realization that as cargo loss is minimized, satisfaction of the professionals in the shipping industry is also enhanced, making a very strong point in the need for consignment accounting as a remedy to the problems of cargo loss.

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Last, Hypothesis 4 focused on how company size and industry experience affected the consignment accounting adoption and its impact on cargo loss reduction. The results showed that bigger companies, those with longer shipping experience in particular were more effective employing consignment accounting and faced less cargo losses as a result. This implies that consignment accounting adoption is enabled by both organizational maturity and the number of resources available.

In summary, this research finds that consignment accounting is useful for minimizing the loss of cargo because of the regional factors, the size and experience of the firm. The results highlight the arguments for increased access to consignment accounting across organisations especially in areas with high rates of cargo losses.

9. Limitations of the Study

However, some limitations resulting from this study cannot be overshadowed: Firstly, the data collection was the result of surveys, the respondents were shipping professionals and there is always the possibility of socially desirable response, or the possibility of recall bias. The respondents could have overstated the degree of consignment accounting or understated the rates of cargo loss through reporting if they considered the consignment accounting to be an effective remedy for functional problems. This reliance on self-reported data must be viewed as a key weakness of the study.

Second, first, although the authors recruited 400 participants from five different regions and the study incorporated useful screening criteria, the reasoning of the sample size and scope could be still insufficient to establish its generalization for the whole global shipping industry. The survey target population excluded some geographic areas—Jordan, Norway, Greece, Denmark, and the Middle East—so the conclusions might be relevant to other shipping companies only inasmuch as they operate under similar economic and logistical conditions. It is recommended that future research with a greater number of participants and from different age groups and genders would give a wider view.

This research is confined to a cross-sectional study design, meaning that most of the data collected were only at one particular time. Even though this study was able to compare the data collected before and after the introduction of consignment accounting, transition changes in the rate of cargo loss were not monitored. The measurement of cargo loss over a longer period in terms of consignment accounting, more prolonged longitudinal studies would give more solid and comprehensive information.

Further, the study failed to concern other aspects that explain loss of cargo for instance, the technology, training, or the adoption of other loss prevention systems. It possible to expand the list of these variables for the purposes of the subsequent research to develop a clearer understanding of the major factors that could influence reduction of cargo losses in the shipping industry.

10. Implications of the Study

The results of this research hold several implications for the global shipping industry. Moreover, the study establishes that consignment accounting reduces the risk of cargo loss as practice demonstrates. Through giving the right information and responsibility, consignment accounting makes smiling company a practical ability towards avoiding variety and lessening effect larger of cargo loss. This could result into more secure, efficient and safer operational environment that would greatly improve the general profitability and stability of the shipping channels [4, 19].

To the policymakers, the study reveals that policies require regional adaptation to fit in the growing economic and logistical contexts of the regions [20, 21]. The variation in effectiveness across regions implies that consignment accounting might have to be localized to meet certain region's needs. For policy makers in areas where consignment accounting has not been adopted fully, the study will provide a basis for arguing for proper adoption, especially in areas that experience high levels of cargo loss [22, 23].

In addition, the study shows that consignment accounting requires industry experience and need large companies to be implemented successfully. Published research participants reported that consignment accounting outcomes were more favourable in larger companies, with larger resources and

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experience, implying that the shipping market might require the capacity building efforts for the solids companies especially the new ones or without prior knowledge of consignment accounting. Many different shipping firms, including small and large, should consider the implications of consignment accounting, and it must be reiterated that more needs to be done to encourage small shipping organizations to utilize them.

Last but not least, it is useful to note that the results of the present research have clear application to enhancing shipping operational processes and logistics management. The paper recommends that shipping companies should embrace consignment accounting as part of the overall loss prevention framework. If implemented with the vision of real-time reporting and accountability, consignment accounting limits the risks inherent in lost cargoes, builds customer trust and optimizes performance for all the players in the supply chain.

11. Future Recommendations

Based on the results and the flaws of the present research, several implications for the future work and real-world use are proposed. First, future research needs to draw a larger sample from areas other than the five areas examined here. Therefore, future research based on other regions' economic settings, shipping function, and legislation can provide a rich insight into the generalizability of consignment accounting to reduce loss of cargo.

Second, longitudinal research design is suggested to investigate the impact of consignment accounting on cargo loss over time. This paper only focused on the short-term analysis; a similar study using a long-term perspective may help to determine the longevity of and future efficacy of consignment accounting in curbing cargo loss. Knowing with certainty whether or not the positive effects discussed boast longevity when it comes to consignment accounting is understandably important when evaluating the application of the model for the distant future of the shipping industry.

Third, further research might investigate the contribution of technology in the management of consignment accounting systems. Given the emerging smart solutions like blockchain, IoT and ML it may be possible to incorporate these technologies with consignment accounting with an aim of improving on cargo tracking, minimizing errors besides improving on real time decision making. Exploring how these technologies could enhance consignment accounting also leads into enhancing the reason it has for minimizing cargo loss.

At the same time, the significance of training employees, as well as the organisational culture in relation to successful consignment accounting should be discussed. The papel of training programmes and the corporate culture as factors influencing the implementation of consignment accounting and its impact on the success of cargo loss reduction could be explored in future research.. Being able to account for the human factor in the implementation of consignment accounting will be important to shipping companies aspiring to getting the most out of this technique.

Lastly, based on this study's findings, it is suggested that subsequent research seeks to establish appropriate strategies for implementing consignment accounting in various categories of shipping firms, including large international carriers and small regional players. Peculiar recommendations or standards for effective implementation of consignment accounting may aid industry players in the management of the advances and pitfalls of cargo loss prevention and hopefully enhance the overall performance.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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